Multi-batch Slip stacking for Numi

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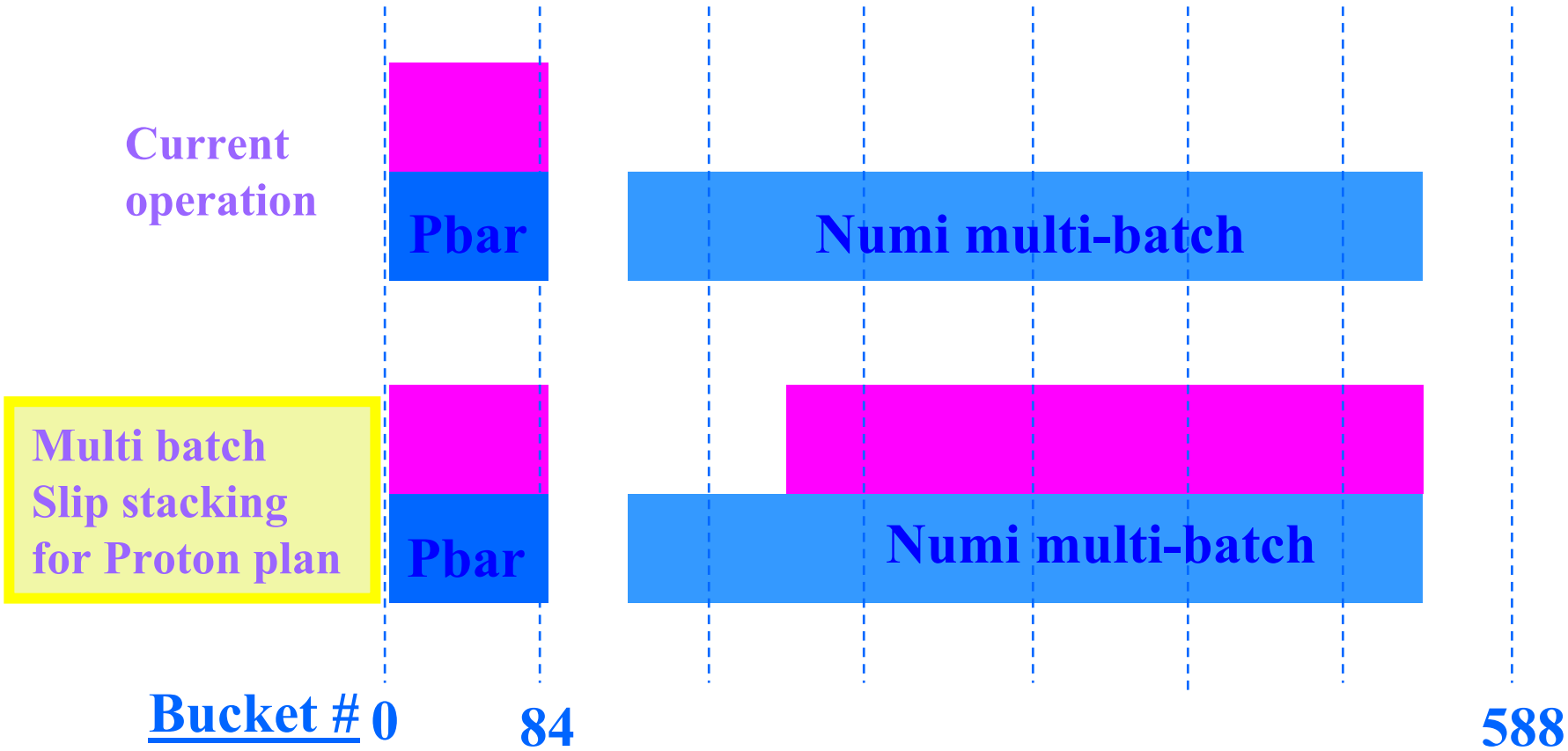
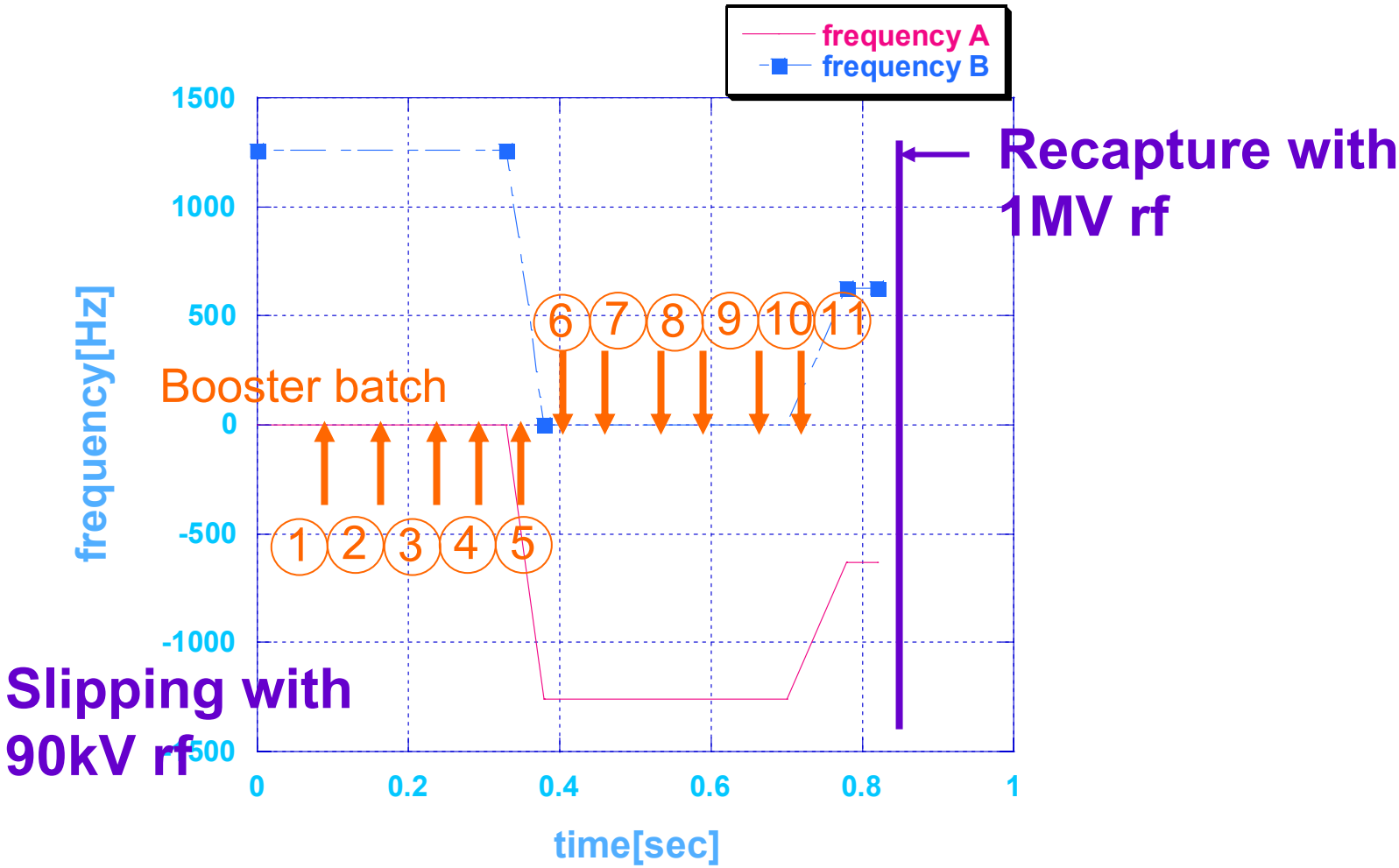
- Goal
- Scheme
- Status of beam study in Main Injector
- Beam loss issues
  - Beam loss mechanism
  - Simulation for kicker gap loss
  - Beam measurements
- Summary

Our goal

- **Intensity: 11 X 4.3E12 = 4.7E13 ppp**
- **Total beam loss < 5%**

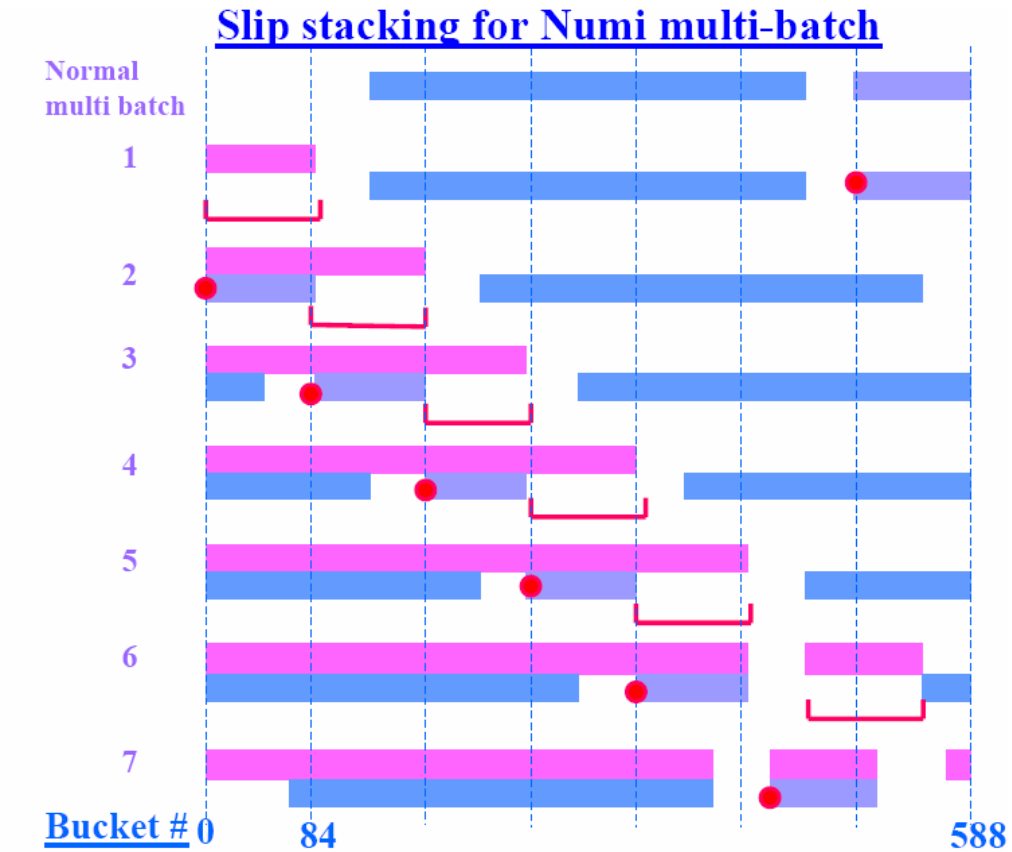


Multi-batch Slip stacking for Proton Plan



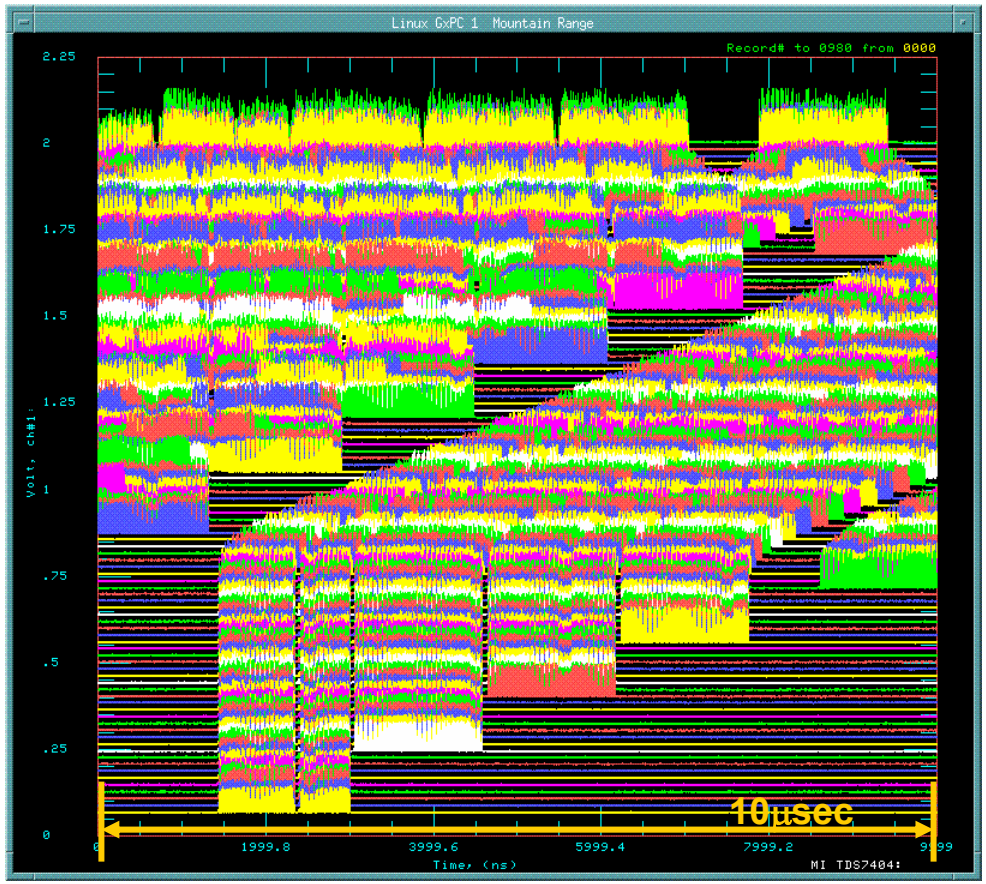
Multi-batch Slip stacking process

- **Inject 11 X 84 bunches from Booster.**
- **→ 1 double batch to Pbar and (1 single + 4 double batch) to Numi**



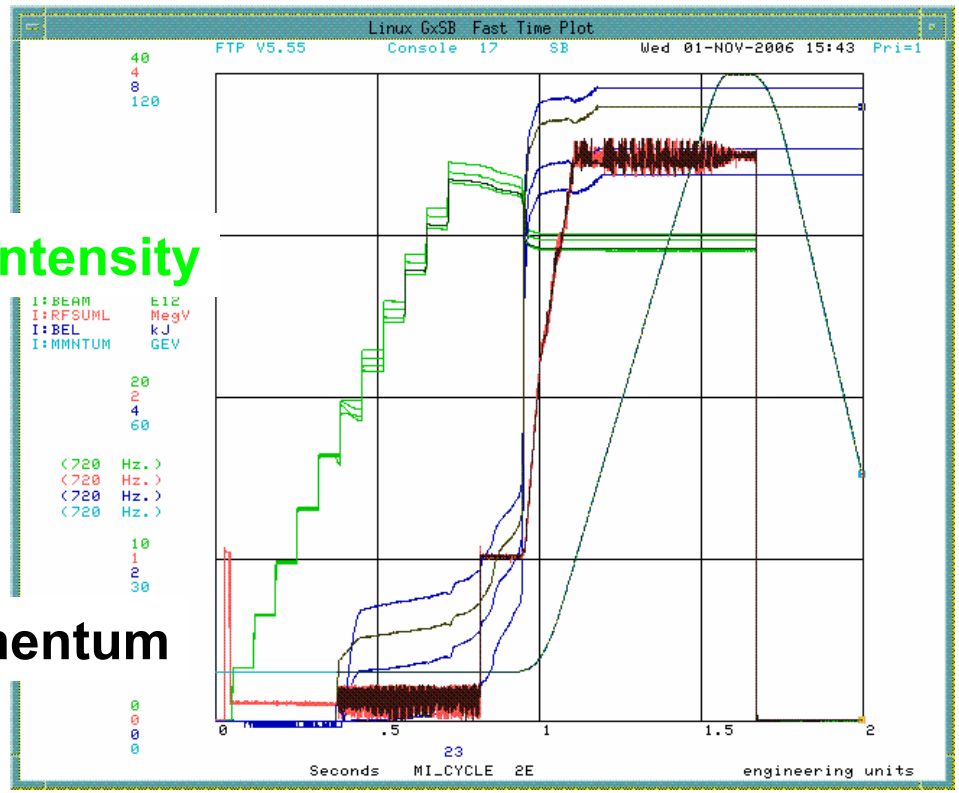
Multi-batch Slip stacking process at 8GeV

- **Wall current monitor signals at injection**



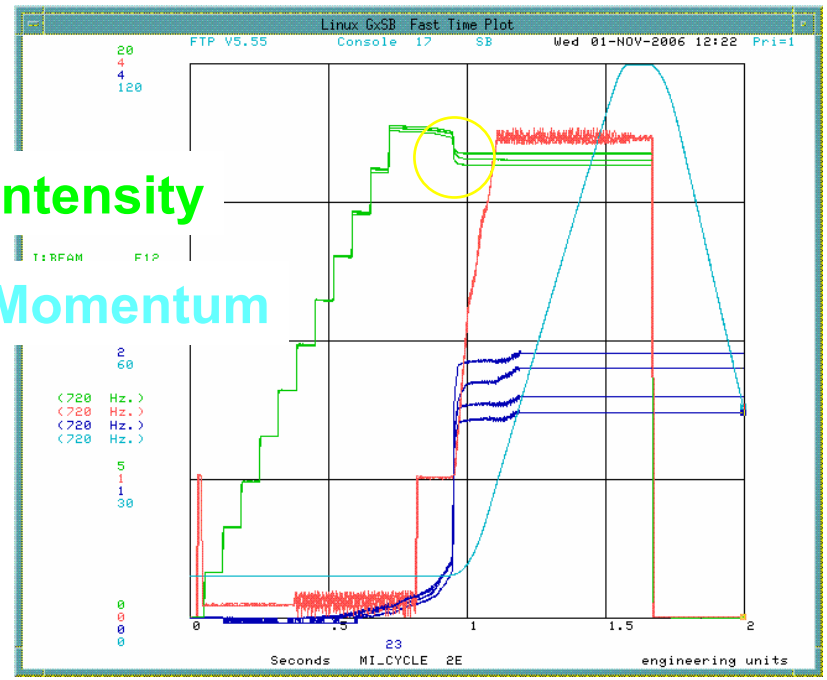
Status of Multi-batch Slip stacking studies

- Beam has been accelerated to 120GeV.
- Intensity at 120GeV: 3.0E13 ppp
- Working on understanding and reducing the beam loss

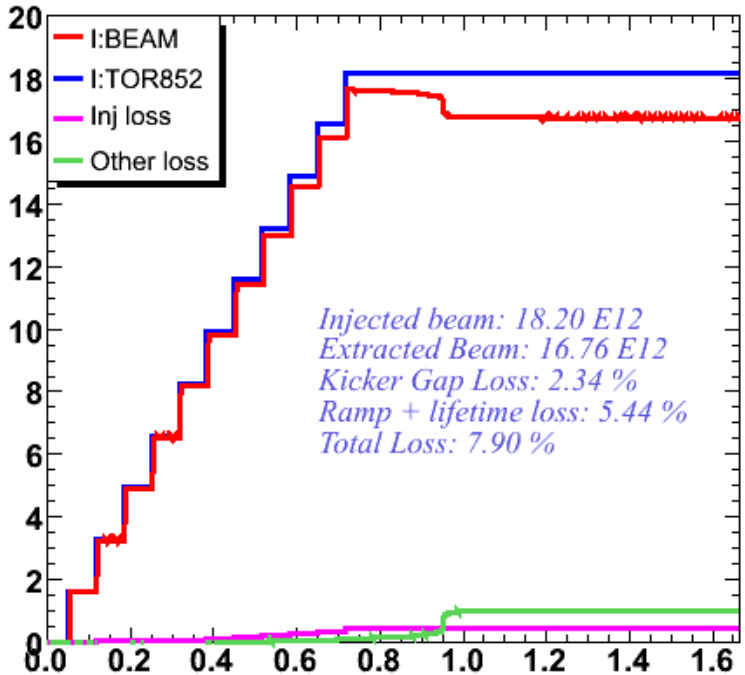


Beam loss issues

- **Signal on DCCT in Main Injector**



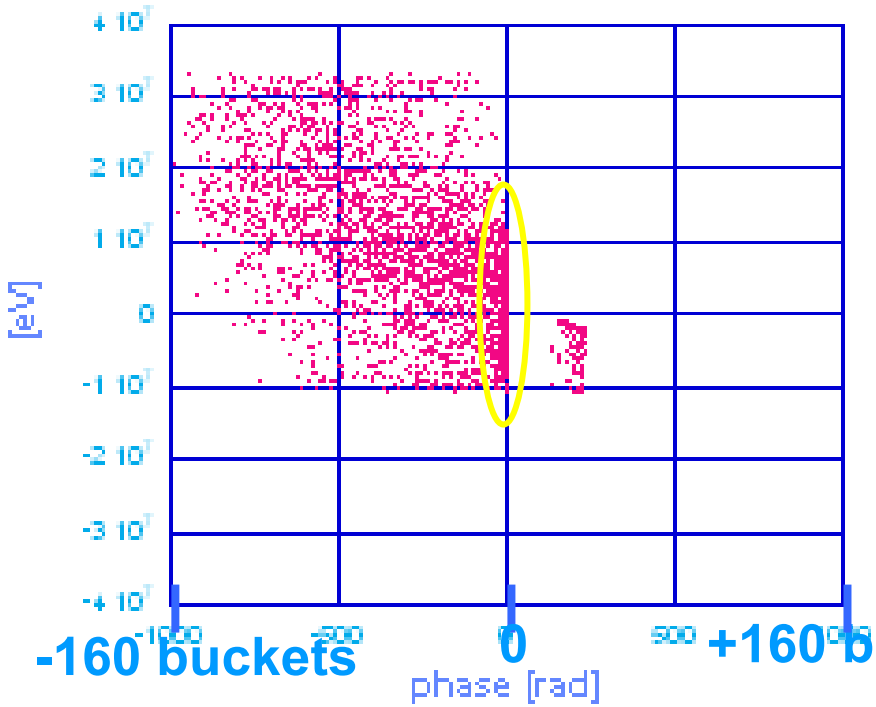
- **Total intensity in MI**
- **Beam intensity from Booster**



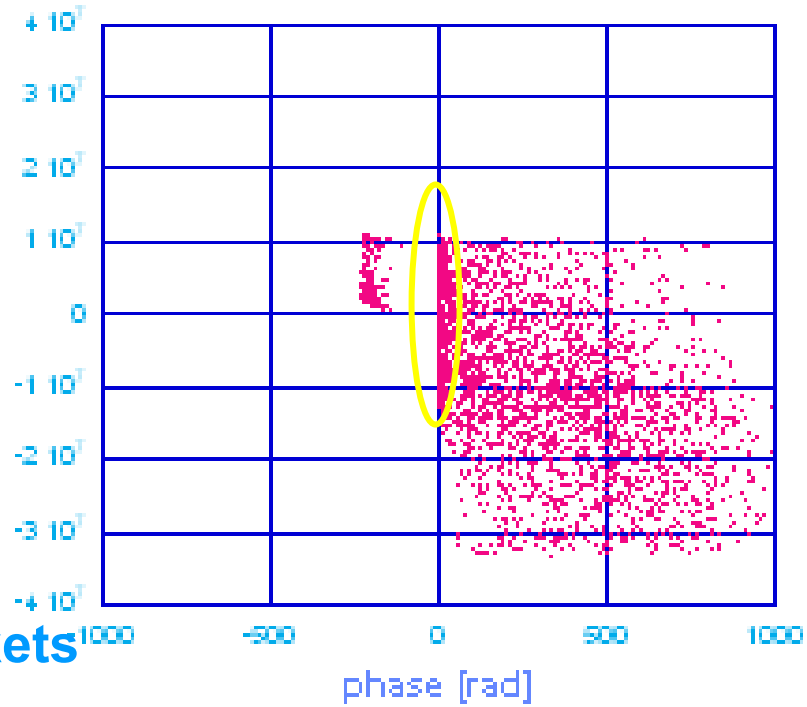
- **Loss @ kicker gap**
- **Loss @ beginning of acceleration**

Beam loss with offset frequency

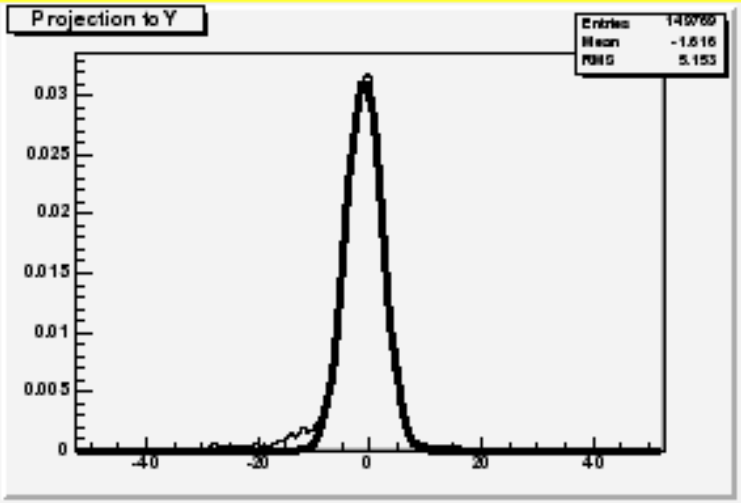
- With higher frequency

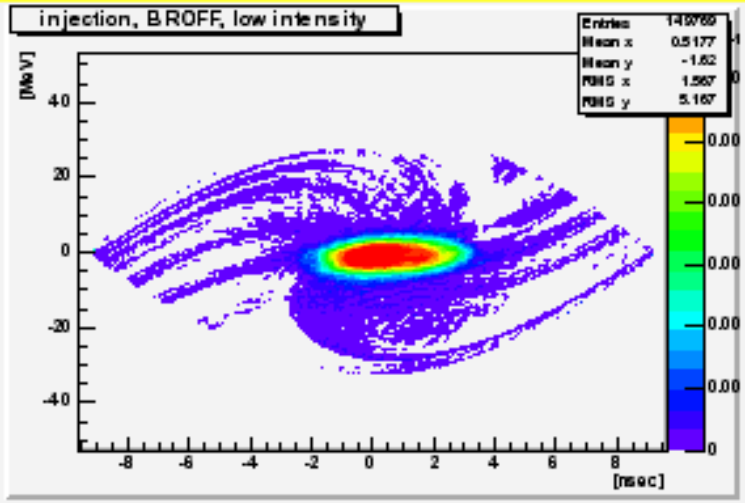


- With lower frequency

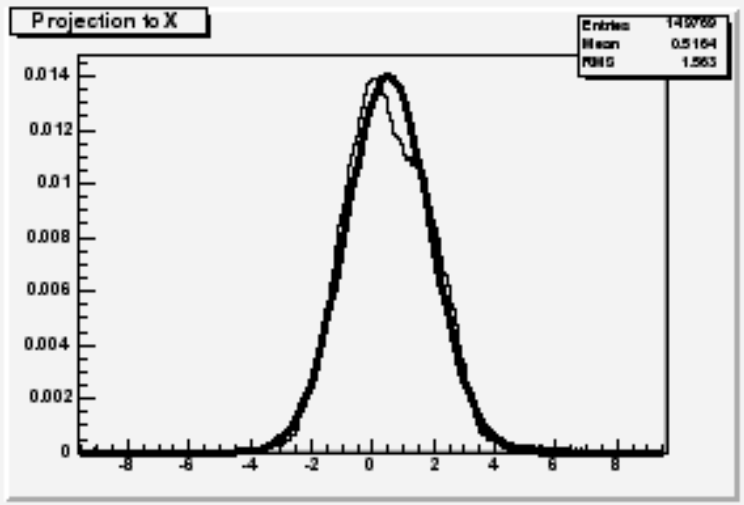


Emittance measurements at injection



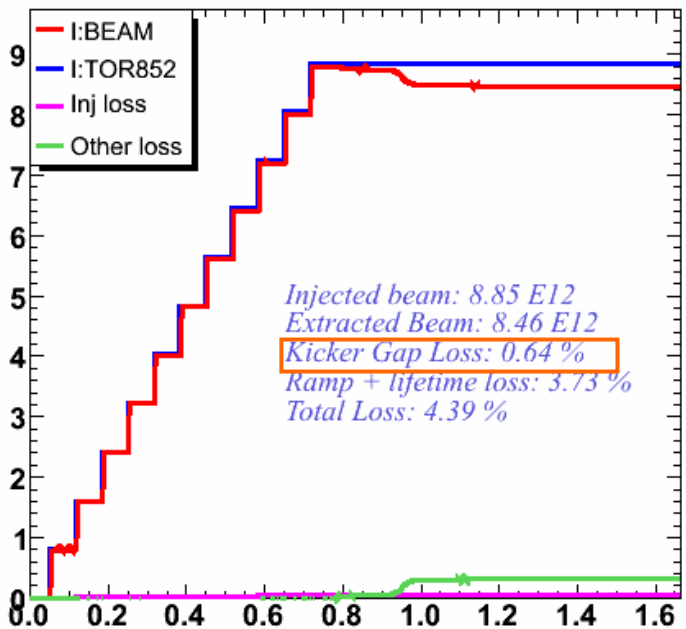


Bunch length: +/- 2.8nsec
Energy: +/- 6.5MeV

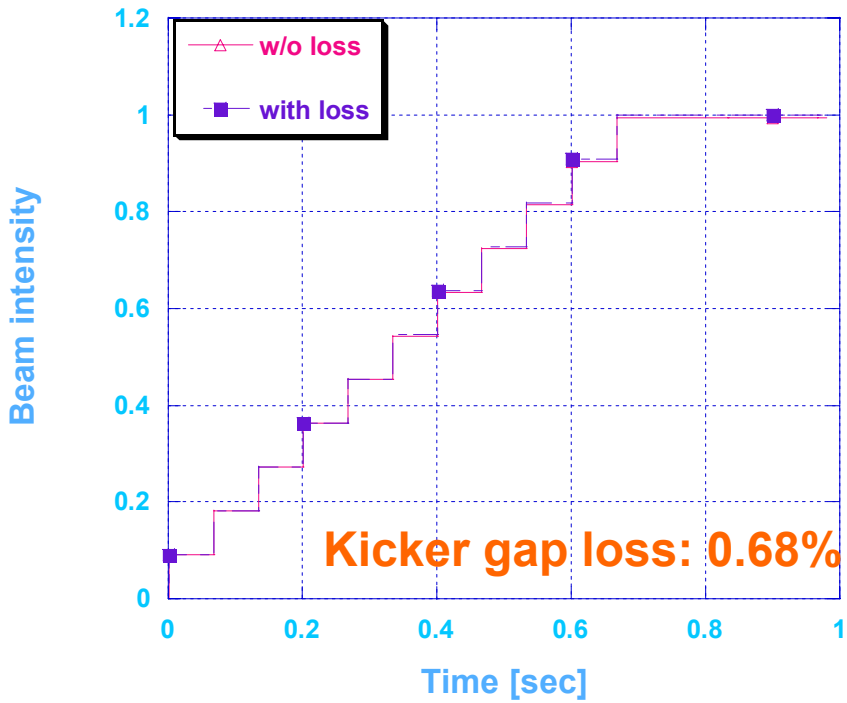


Comparison between simulations and measurements

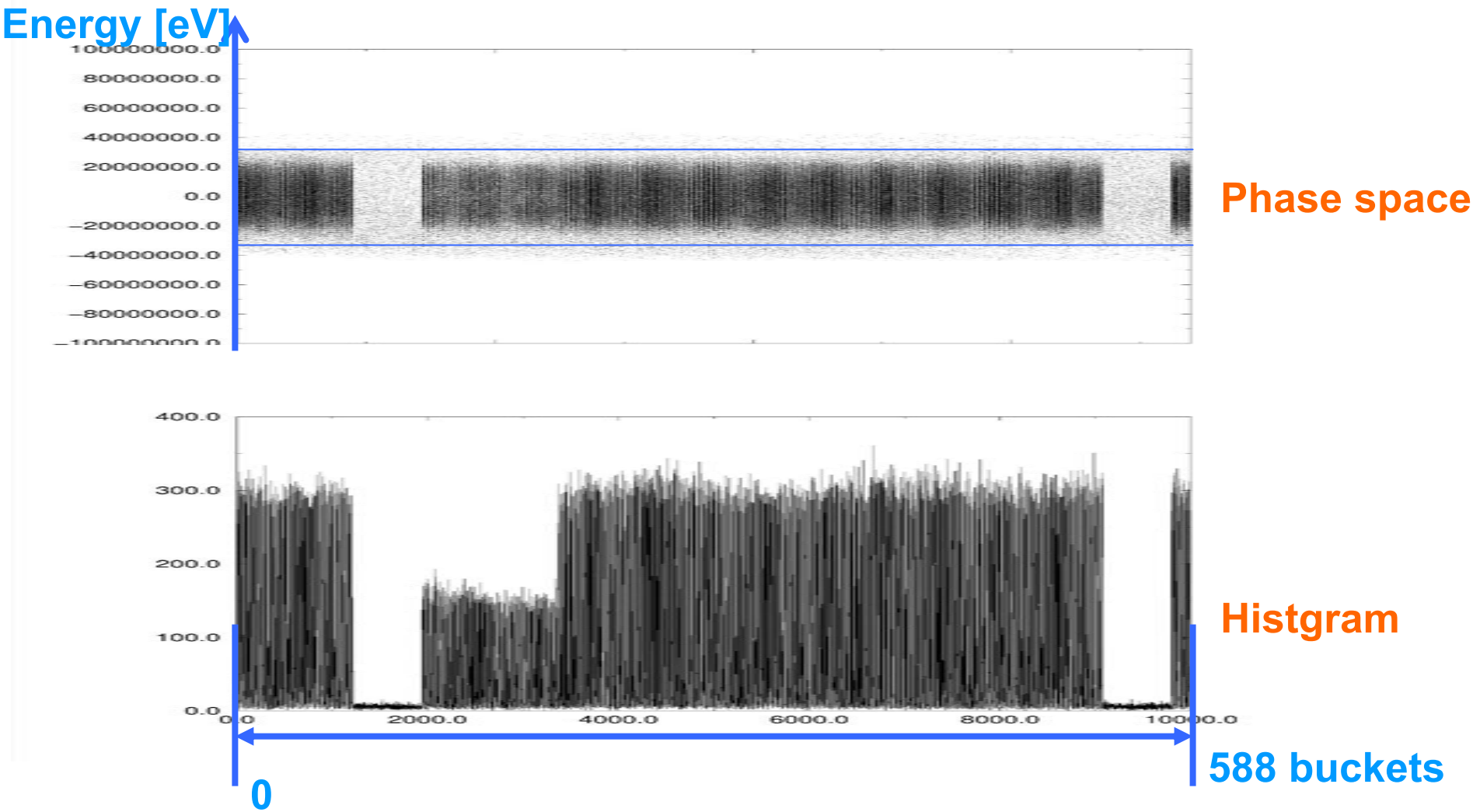
- Measurements



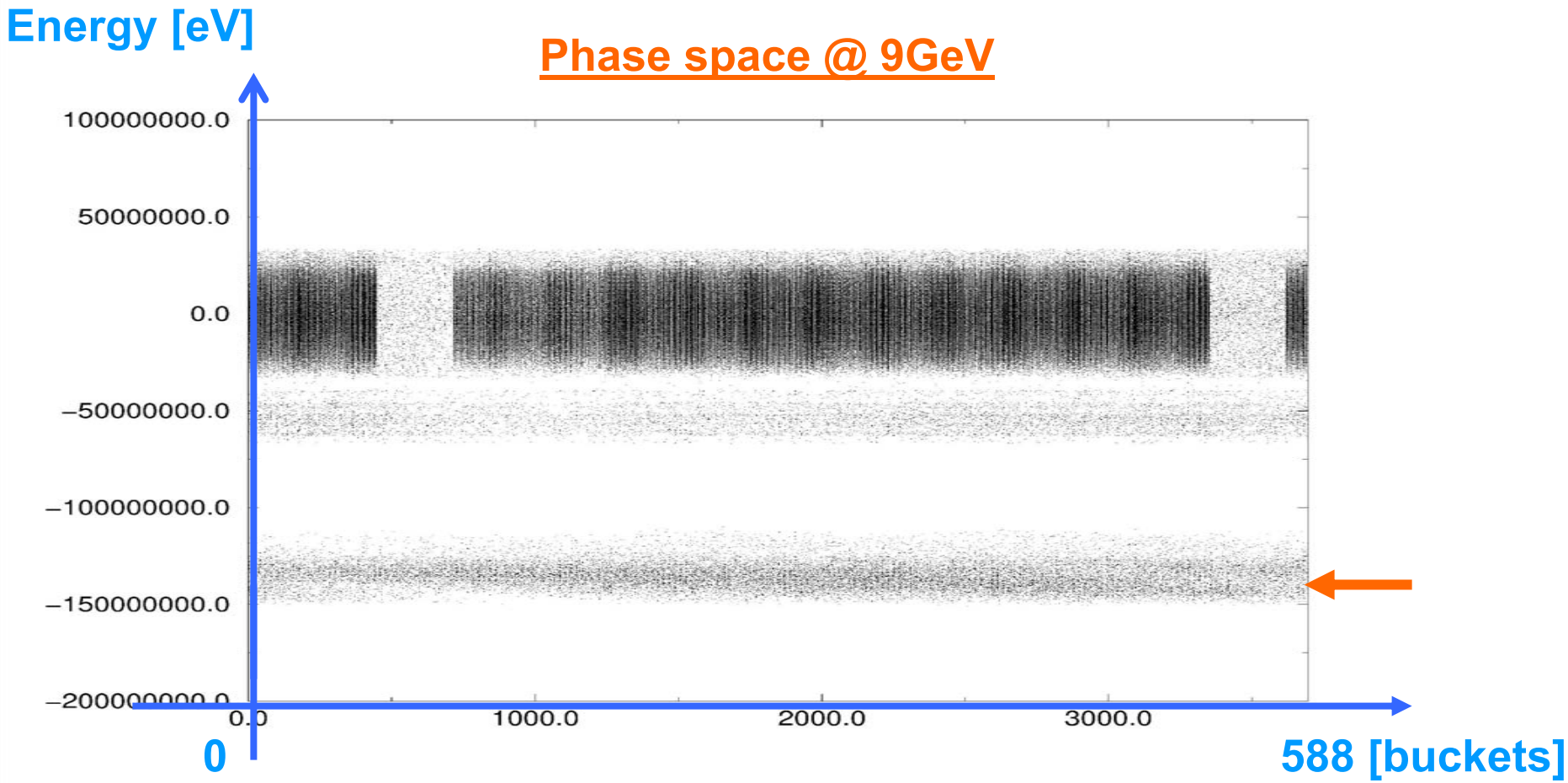
- Simulation



Phase space before acceleration



Phase space after acceleration



Summary and Plan

- 11 batch Slip stacking scheme was verified in Main Injector.
- Beam has been accelerated to 120GeV.
- Beam loss issues were studied with simulation and measurements.

- Continue to work on simulation for the beam loss and optimize rf parameters.
- Beam studies with high intensity.
- Make 11 batch Slip stacking operational for Numi only cycle
- Final scheme is going to be operational after collimators are installed in MI (next summer shutdown).